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BLOOD CELLS DETECTION & COUNTING

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ABSTRACT

Image processing techniques are widely used in the domain of medical sciences for detecting various diseases, infections, tumors, cell abnormalities and various cancers. Detecting and curing a disease on time is very important in the field of medicine for protecting and saving human life. There are three types of primary cells in human body red blood cells, white blood cells and platelets. Their functionalities are different. In this paper red blood cells detection and counting is done and it is observed that which cells are normal and which are infected.

KEYWORDS: Red Blood Cells, Detection, Counting

1. INTRODUCTION

In this paper image processing techniques are used to detect and count normal and infected red blood cells. If the image contains the normal red blood cells than it will make boundaries and detect their edges but if it is an infected and abnormal cell its boundaries and edges cannot be detected. Segmentation plays an important role while detection of red blood cells. Red blood cells clinically play a vital role in the diagnosis of many blood related diseases. The normal red blood cell is always disk like in shape; their major functionality is to circulate oxygen in the whole body [1].

Counting of red blood cells in an image is very important but counting them manually is a very tedious and time consuming process their must be some counting conflicts also generated while manual counting. So in this paper cells are not only detected but also counted automatically [2]. In the remaining paper section 2 describes the related work, section 3 describes the methodology, section 4 describes the results, section 5 describes the conclusion and section 6 describes references.

2. RELATED WORK

In [1] the automated way of red blood cells detection and the classification of different shapes of red blood cells were described. The techniques used for cell detection and classification were edge detection and segmentation. In the edge detection, gradient and laplacian techniques were used, and then feature extraction and image segmentation, then the histogram of image was displayed to see the places where the red blood cells were more in number, and then an artificial neural network was applied.

In [2] using Hough transform it became easier to count cells more efficiently and accurately. Other methods which used in [2] were Image enhancement and identification, Hough transformation in edge detection and Counting.

The techniques mentioned in [3] were helpful in detecting vast number of diseases. Older techniques of detection and counting were slow. This technique showed the automated view of blood cells counting and identification.

The techniques used in this paper were Image capturing, Image detection, Image cleaning, Nucleus and cytoplasm selection, Feature extraction andClassification.By performing the mentioned steps it had seen that, this was an innovative approach of getting microscopic operations and perform steps on them for cells detection and counting.

The purpose of including [4] was to introduce another method for detecting cells. Mostly during the tests conducted for the detection of leukemia white blood cells are mostly the part of tests. Nucleus and cytoplasm are the major key contents of WBCs for detecting the cell it must be kept in mind that if an object has a nucleus and cytoplasm then it can be declared as a cell and if their functioning and consistency is correct then it is said to be a normal cell actually applying image processing techniques on WBCs is a very critical task because WBCs are of different sizes and shapes so to identify that which is a WBC it is an efficient way to check its cytoplasm and nucleus. WBCs play a vital role in defending the body from various diseases. The techniques used in this paper were Image capturing, Convert image to gray scale, Edge detection, Finding nuclei using GVF snake algorithm, Segmentation, Subtraction of nucleus from gray level image, Finding cytoplasm using zack thresholding, Resultant image.

The reason of considering [5] in this paper is that when tests are conducted for detecting cancer the state of blood cells at that time is also considered. Either the blood cells are performing normal function or they are present in the particular area of body or not. In this paper the 4 techniques were followed. The first stage started with taking a collection of CT images; the second stage applied several techniques of image enhancement, to get best level of quality and clearness. The image enhancement techniques used were Gabor filtering, fast Fourier transformation, auto enhancement. The third stage applied image segmentation algorithms which played an effective role in image processing stages. The fourth stage obtained the general features from enhanced segmented image which gave indicators of normality or abnormality of images.

Table 1: Analysis of Related Work

S-NO	Author	Technique	Features	Results
1	Mokhled S. AL-TARAWNEH	Image capture, enhancement, segmentation, extraction	Abnormal cancer causing cells detection	The was an efficient and successful technique
2	Farnoosh Sadeghian, Zainina Seman, Abdul Rahman Ramli, Badrul Hisham Abdul Kahar and M-Iqbal Saripan	Edge detection, GVF snake algorithm, Zack thresholding	WBCs detection by identifying their cytoplasm and nucleus	The results shown after deploying above technique are 92% accurate for nucleus detection and 78% for cytoplasm detection.
3	Lorenzo Putzu, Cecilia Di Ruberto	Image identification, cleaning, classification	WBCs detection by identifying their cytoplasm and nucleus	This was an efficient and robust way of finding and detecting WBCs on the basis of cytoplasm and nucleus.
4	Navin D. Jambhekar	Edge Detection, Gradient based Edge Detection, Laplacian based Edge Detection, Feature Extraction, Image Segmentation, Histogram, Classification using Artificial Neural Network.	RBCs detection by identifying their different shapes.	The multi level perception model gives 81% accuracy and extracted the RBCs, sickled cells and overlapped WBCs.
5	Mausumi Maitra , Rahul Kumar Gupta, Manali Mukherjee	Image Enhancement and Identification of Red Blood Cells, Hough Transform in Object Detection, Counting	Classification, identification and counting of red blood cells.	The laser blood citometers cannot accurately count the blood cells they actualy destroy the blood samples and canot work on images, using hough transform we are able to count cells more efficiently and accurately.

3. METHODOLOGY

In this paper the red blood cell detection is done using image segmentation in which edge detection and basic morphological techniques are applied.

3.1 Detection of Cell

After reading the image cell detection is carried out in which segmentation for object detection is used but the basic rule which can be implemented while segmenting the object is that their should be an enough contrast between the background and the image. Figure 1a, 1b shows the normal and infected cells and figure 2a, 2b show the grey scale images of normal and infected red blood cells.

Figure 1a: Normal Red Blood Cell Image

Figure 1b: Original Image of Infected Cells

Figure 2a: Normal Image Converted to Grey Scale

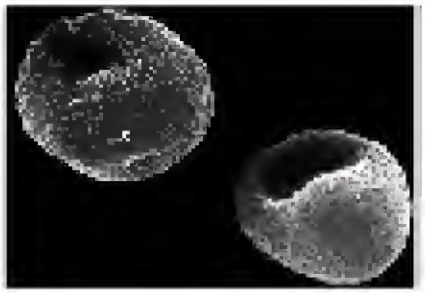

Figure 2b: Infected Image Converted to Grey Scale

For this segmentation the gradient of an image can be calculated for this purpose threshold is applied after converting the image to binary for distinguishing between foreground and background. Figure 3a and 3b shows the binary image of normal and infected cells.

Figure 3a: Binary Image of Normal Cells

Figure 3b: Binary Image of Infected Cells

For calculating a threshold a sobel is applied on an image and by using the edge function in matlab the edges of an image can be detected [6]. Figure 4 shows the binaryimage after applying sobel on normal cells image.

Figure 4: Threshold Applied on Binary Image

3.2 Dilation of Image

Although segmentation distinguishes the high contrast objects but it will not properly highlight the outline of the object of interest so for this purpose as the gaps and lines surrounding the image are shown so to remove the linear gaps a linear structuring element is used to dilate the image on which sobel is applied [6]. The figure mentioned below shows the dilated image.

Figure 5: Dilated Cell Image

3.3 Filling Gaps

After dilation the proper outline of the area of interest in an image is shown so now the filling of interior gaps of the image inside the cell are needed to be removed by using infill function in matlab. In the figure 6 filled gaps are shown.

Figure 6: Filled Gaps of a Dilated Image

3.4 Object Smoothing

Object smoothing is required for giving the original look to the object present in the image for this purpose the image will be eroded by using a proper structuring element [6]. Figure 7 shows the eroded image.

Figure 7: Eroded Image

In the figures 8a and 8b, the eroded image is then converted into RGB it is observed that the boundary is drawn along the normal cells and defected cells are not detected.

Figure 8a: Detected Normal Cells

Figure 8b: Infected Cells

3.5 Counting

For counting the objects in the image connected component labeling is used in which the components having same labels are counted and we finally have the total object count in the image. Figure 9 shows the flow of work done and mentioned in the paper.

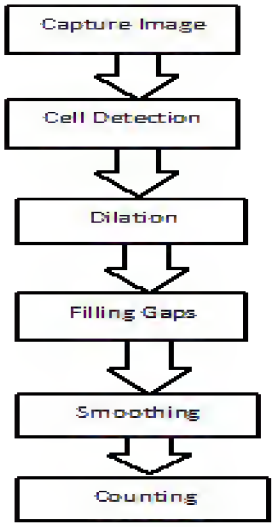

Figure 9: Methodology of Cell Detection

4. CONCLUSIONS

By applying the above mentioned techniques the red blood cells detection and counting is achieved and 70% to 80% results are obtained with accuracy so in future the analysis of white blood cells and platelets count in the human body will be taken under consideration.

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